PRIORITY SCHEDULING

HLSUA

FORUM XXV

OCTOBER 18

1977

PHOENIX, ARIZONA

HARRY QUACKENBOSS, MULTICS MARKETING (PHOENIX)

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RESOURCE ALLOCATION FACILITIES

- LOAD CONTROL GROUPS
  - * CONTROL MAX (WEIGHTED) LOGGED IN USERS BY GROUP
  - * DEFINE BUMPING (PREMEPTING) RULES
- WORK CLASSES
  - * DYNAMIC CONTROL OF CPU ALLOCATION

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WORK CLASSES: PERCENT MODE

- EACH CLASS ASSIGNED A GUARENTEED MINIMUM OF CPU AVAILABLE
- WORK CLASS "SIZE" IS CONSTANT AS # OF USERS CHANGES
  (BUT PER-USER RESPONSE VARIES)
- IDLE CPU IS AVAILABLE FOR RE-DISTRIBUTION
- SUM OF PERCENTS MUST = 100%

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WORK CLASSES: DEADLINE MODE

- EACH CLASS ASSIGNED

  R1 - RESPONSE TIME AFTER INTERACTION

  Q1 - QUANTA FOR FIRST INTERVAL

  R2 - INTERVAL BETWEEN SUBSEQUENT QUANTA

  Q2 - QUANTA FOR SUBSEQUENT INTERVALS

PER-USER NON-INTERACTIVE USAGE RATE =

$$\frac{Q2}{Q2 + R2}$$

EXAMPLE: $\dfrac{.25 \text{ SEC}}{.25 + 4.75 \text{ SEC}} = 5\%$ OF 1 CPU

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REALTIME WORK CLASSES

- CAN BE ADDED WHEN SCHEDULER IS IN % MODE OR DEADLINE MODE
- ASSIGNED QUANTA & RESPONSE TIME LIKE DEADLINE MODE
- READY PROCESSES PLACED IN REAL-TIME QUEUE
- USED FOR:

  INITIALIZER

  IO DAEMON

  DEMO FOR PROSPECTS

  BENCHMARKS

  HIGH PRIORITY USERS

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CHANGEABLE SCHEDULING PARAMETERS

TEFIRST	-	TIME QUANTA AWARDED AFTER INTERACTION
TELAST	-	SUBSEQUENT TIME QUANTA
TIMAX	-	DETERMINES HOW "NON-INTERACTIVE" JOBS ARE SORTED INTO READY QUEUE. A PROCESS WILL NOT BE SORTED LOWER THAN TIMAX SECONDS SINCE INTERACTION
MAXE	-	MAX ELIGIBLE PROCESS
WSF	-	WORKING SET FACTOR
WSA	-	WORKING SET ADDEND

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READY- HAS WORK TO DO. READY TO RUN

RUNNING- EXECUTING ON A PROCESSOR

BLOCKED- NOT READY. AWAITING AN EVENT:

- o INPUT FROM TERMINAL
- o TAPE MOUNT
- o SIGNAL FROM ANOTHER PROCESS

EVENT OCCURANCE IS AN INTERACTION AND CAUSES A WAKEUP.

WAITING- WAITING FOR A PREDICTABLY SHORT EVENT.

- o DISK PAGE ARRIVAL

STOPPED- PENDING DESTRUCTION BY INITIALIZER

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ELIGIBILITY:

- o NOT ALL READY PROCESSES ARE CANDIDATES TO RUN
- o ELGIBILITY IS AWARDED SUBJECT TO:

(A) ELIGIBLE PROCESSES MAXE

(B) WORKING SET ESTIMATES SYSTEM W.S.

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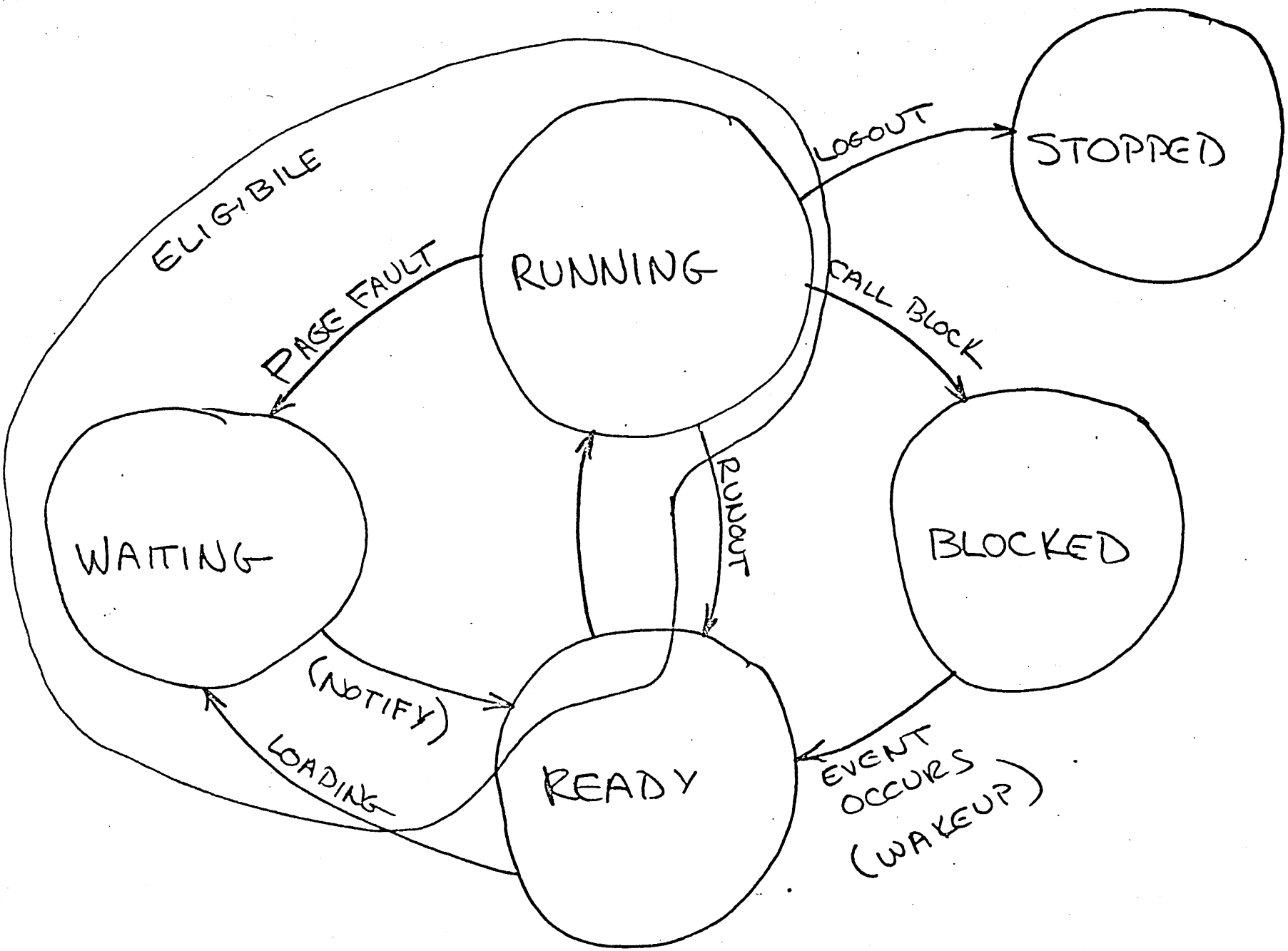
ELIGIBILE
LOGOUT
STOPPED
RUNNING
PAGE FAULT
CALL BLOCK
WAITING
RUNOUT
BLOCKED
(NOTIFY)
LOADING
READY
EVENT
OCCURS
(WAKEUP)

GUIDELINES

(1) CAUTION: USE REALTIME SPARINGLY

- WHEN DEADLINE ARRIVES, ELGIBILITY IS AWARDED WITHOUT LOOKING AT MAXE, WSF
- INITIALIZER SHOULD BE HIGHEST PRIORITY REALTIME PROCESS. (AVOID DEADLY EMBRACES DURING FATAL PROCESS ERRORS)
- LOAD CONTROL CAN HELP KEEP FROM OVER-BOOKING

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(2) IF SOME WORK CLASSES ARE SMALL (10%), RESPONSE AT USER LEVEL WILL BE MORE CONSISTENT WITH SHORT QUANTA:

EXAMPLE: TEFIRST = .75 SEC — 1 SEC
TELAST = .25 SEC — .5 SEC

PERMITS GOOD RESPONSE TO SMALL COMMANDS, BUT PROHIBITS HOGGING THE MACHINE.

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TRANSACTION PROCESSING ENVIRONMENT EXAMPLE

(1) PLACE "WORKER" PROCESSES IN % MODE WORK CLASS, CHOOSE TEFIRST & TELAST IN ACCORDANCE WITH TRANSACTION CHARACTERISTICS. (HEAVY TRANSACTIONS ⇒ LONGER QUANTA TO MAXIMISE THROUGHPUT)

(2) PLACE I/O PROCESSES (HANDLING TERMINALS) IN REALTIME CLASS, CHOOSE R1, Q1, R2, Q2 COMPATIBLE WITH LINE SPEEDS AND TERMINAL I/O VOLUMES.

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